

DOCUMENT RESUME

ED 122 859

88

IR 003 490

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TITLE MICA, Managed Instruction with Computer Assistance:
Level Five. An Outline of the System's
Capabilities.
INSTITUTION Madison Public Schools, Wis.
PUB DATE 76
NOTE 28p.
EDRS PRICE MF-\$0.83 HC-\$2.06 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Continuous Progress
Plan; Elementary Secondary Education; Individualized
Instruction; *Individualized Programs; Information
Processing; Information Retrieval; *Instructional
Systems; Instructional Technology; *Interaction;
Program Descriptions
IDENTIFIERS *Computer Managed Instruction; Elementary Secondary
Education Act Title III; ESEA Title III; Madison
Public Schools; Managed Instruction with Computer
Assistance; MICA

ABSTRACT

Computer technology has been used since 1972 in the Madison, Wisconsin, public schools to control the flow of information required to support individualized instruction. Madison's computer-managed instruction system, MICA (Managed Instruction with Computer Assistance), operates interactively within individualized instruction programs to provide constant monitoring of student progress. The central principle underlying MICA is that teachers should be 100% free of clerical and non-instructional tasks. MICA is designed to service any type of instruction selected by the school and can handle a broad spectrum of commercial and home-grown curricula. Through five generations of development, its designers have built improved systems using educational insights gained from operating the system's predecessor for one year. The capabilities and options available through level five of the MICA system, implemented in 1975-76, are outlined. (Author/PF)

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MADISON PUBLIC SCHOOLS
COMPUTER MANAGED INSTRUCTION
E.S.E.A. TITLE III PROJECT

MICA

Managed Instruction with Computer Assistance

Level 5

An Outline of the System's Capabilities

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Spring 1976

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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I. PREFACE

If we have learned anything from educational research in the last 25 years, it is that children differ. Children differ, not so much in their capacity to learn, as in their emotional and intellectual readiness to learn. We have evidence, too, that each child has a unique developmental clock that must be recognized and accommodated. To present learning material or experiences which violate the rhythms of that developmental clock can be damaging to a child's subsequent development. Finally, styles of learning and rates of learning are highly dependent upon the needs of the individual learner.

Most classroom teachers today know how children differ and are attempting to accommodate these differences. Such attempts have spawned a plethora of strategies and services all designed to individualize learning: everything from continuous progress instruction to learning centers, instructional materials centers, programmed learning, student instructional packages, student contracts, team teaching, multi-unit organization, special educational services, and on and on. Teaching is no longer a cottage activity; at its best, it is a sophisticated, human activity requiring a variety of professional judgments about each child. Such judgments require information and lots of it. And information, improperly managed, can become a jungle that saps a teacher's time and energy, actually substantially reducing the time available for face-to-face instruction with children.

It is clear that if we wish teachers to accommodate children's learning differences, we must help them with the information load which such a role imposes. The computer is one tool which offers hope in that regard. This document gives

an overview of how computer technology has been used in the Madison Public Schools to control the flow of information required to support individualized instruction. Computer managed instruction is not a panacea; however, it does offer significant hope of making individualized instruction a reality.

Finally, to those who fear that computers depersonalize, an insight. Computers are non-human; only people can be human or inhuman.

Lee H. Hansen, Director
Research & Development Department

II. SYSTEM DESCRIPTION

The purpose of this paper is to outline the present capabilities of Madison's CMI system for an audience of educators, parents, and students who do not want to know the technical details of the system or do not have the time to read either the user documentation from a teacher's or aide's point of view or the systems documentation from a programmer's point of view. Their only question is what can CMI do to help teachers individualize instruction.

Madison Public Schools' CMI system MICA, "Managed Instruction with Computer Assistance", has been in development since 1972. At that time Dr. Frank Baker and seven graduate students at the University of Wisconsin began the software work to support an individualized math program at Sherman Elementary School. The MICA system was designed to handle the instructional information needs of continuous progress education and to operate interactively within individualized instructional programs. Since 1972 the system has gone through five generations of development involving approximately 20 man years of analyst and programmer time. This effort has been supported by funding from E.S.E.A. Title III, Madison Public Schools, and the UW Laboratory of Experimental Design. A sixth generation is now being designed; current plans call for Level 6 to be operational in the fall of 1977.

Through each generation of development the design goal has been to build into the system the educational insights gained from operating the system's predecessor in the Madison Public Schools for approximately one year. Few CMI projects in the nation have the opportunity for integrating systems design work with field testing in such a dialectical manner. Likewise, few systems have been able to base both curriculum and systems work so firmly in the school-based inquiry mode of development where the analysis and programmers are employed by

and intimately involved with the public school system in both the computer and instructional problems of CMI.

Rather than have the software developed by a university, a regional laboratory, or a computer vendor, Madison has acquired its own team of software developers from the UW Computer Science Program and has integrated them into the regular data processing shop of Madison Public Schools. Working for the Department of Administrative Services and in close cooperation with the CMI instructional staff in the Research and Development Department, they have daily contact with teachers in designing the system, with curriculum specialists in specifying program parameters, with teacher aides in inservicing and implementing each new version, with students in observing the system in operation, and with educational evaluators in judging the instructional impact of the system on the attitudes and behaviors of students, teachers, parents, and principals.

Such involvement has made the MICA system evolve into a user specified system where each aspect has grown out of school based demands that have been modified and expanded as the results of five complete cycles of field testing in real classrooms with real teachers, students, and aides. This method of development has resulted in a high level of teacher acceptance of the information system.

A fundamental reason for this acceptance is that the MICA program has been oriented toward interactive processing in which the aide operates the terminal during the class hour, generating and recording information which reflects the instructional sequence of events through which the student actually goes as he progresses through the curriculum.

In most CMI or manual systems a student does something, the results are recorded on cards or scan sheets, the results are sent to the computer or printed on charts, and the report comes back the next hour or the next day. This is the situation MICA has been designed to eliminate. Information, if it is needed in the instructional process, is needed immediately. A student wants to know now how he or she has done, a teacher wants to know now what instructional options are available, and a principal wants to know now where a child is in the program; they can't wait for hours, days or weeks. To see why, one must go into the classroom and observe the rhythm and tempo of individualized instruction and measure the pressure under which teachers, aides, and principals function as opposed to their old world of self-contained classrooms and group teaching.

In the traditional classroom one finds a teacher with a single lesson plan and 30 students all using the same textbook to do the same activities within the same time frame. The primary purpose behind this traditional approach is to make teaching easy for the teacher. It does that by reducing the information burden on the teacher to a minimum. All students are doing the same lesson, all will take the same test, the results will fall into a one-dimensional continuum, and the teacher's intellectual energies can be saved, hopefully, for the personal contact with each child as they go through the group exercise. In such a situation knowing becomes a question of "why"; all the "what" questions have been kept to a minimum. What they have done, what they are doing now, and what they can be doing in the future all have a collective answer that applies to all students. Complexity emerges in terms of the number of students the teacher must handle during the day and the variety of abilities within the group that result in the achievement spread. Teacher demands for smaller classes and the

use of ability grouping are in part attempts to keep the information demands of teaching to a minimum. Most teachers feel that the effort to know which of 30 children are having problems with one lesson, much less where or why, is burden enough. Much of the proprietary obsession with "my students" that prevents team teaching is not a result of teachers not wanting to interact with many teachers and many students, but the result of a very real insecurity that develops as the information demands of teaching increase.

In the self-contained classroom, the probability of an event happening approaches one as the teacher attempts to keep everyone doing the same thing. Security is knowing that one will only be responsible for one section of the curriculum and that all students will be on the same page. In such a world, the grade book and the lesson plan are sufficient to record and retrieve the information generated by the instructional program. Yet, even then teachers complain about recording grades and maintaining instructional information on the achievement spectrum. They do so because it takes time away from either instruction or the preparation for instruction.

Imagine, then, the problems associated with venturing into individualized instruction where each student takes an individual pathway through a multi-unit continuous progress curriculum. How is the teacher to deal with ever-changing instructional group composition, instructional interventions, curriculum content, and rates of achievement? While the individualization of instruction put the student at the center of the system design and solved many of the problems perceived as relating to the self-contained classroom, it simultaneously created a new set of problems.

Probably the greatest of these newly created problems is the generation of large amounts of data required to manage instruction and monitor the progress of each child. The collecting, recording, and retrieving of these data each day require abnormally high expenditures of energy on the part of teaching staffs as well as added expenses in the form of teacher aides. Under these conditions, "continuous progress curriculums" have tended to exist for only short periods of time while dedicated staff labored against an avalanche of paperwork.

The problems associated with the implementation of sophisticated individualized programs are compounded by recent changes in the educational environment in terms of student populations, available curriculum materials, instructional methodology, parental involvement in education, and the fiscal resource picture. Teachers in individualized programs face diversified student populations whose needs are only truly met with an instructional system that can cope with students who have highly varying basic abilities, educational experiences, and basic skills. These students, whose rates of learning might vary by as much as a factor of six (Coleman, 1972), require individualized goals. Unique pathways through the curriculum, different learning styles, individually selected assignments, and alternative assessment strategies are required to meet the potential of individualization. In terms of curriculum materials, the primary problem is one of abundance. The last ten years have seen an explosion in the amount and variety of commercial curriculum materials that can be used across the subject spectrum. Just keeping track of what is available, much less what is used within a large school system, has become a major administrative task. How is a teacher to manage the use of multi-texts, supplemental materials, learning packets, modular units of instruction, multiple tests? All of these

materials must be integrated into the instructional system so that at the proper moment the classroom teacher can use the correct instructional material to meet an individual's unique problem.

Added to the increased variability of students and curriculum materials is the development of alternative instructional methodologies beyond those traditionally used in the self-contained classroom. Such methodologies as teaching by objectives, team teaching, open classrooms, modular scheduling, student self-scheduling, small group instruction, and individual goal setting are currently in practice. All of these options are available to support individualization.

With individualization the need for meaningful communication with parents increases. The grade of B- becomes meaningless in a continuous progress curriculum driven by criterion referenced tests or teacher/student conferences. Such communication must meet the dual demands made by parents for both mastery -- "back to the basics" -- and humanization. On the one hand, parents want to know what skills their children have mastered, as well as the reason for their failure to master other skills. On the other hand, the community wants each child to receive individual attention and have alternatives available to him in order to meet the diverse needs of a pluralistic society. Finally, all of these increased demands, complications, and alternatives are taking place in the context of stable student-teacher ratios, declining enrollments, fiscal controls on educational spending, and rapidly growing educational costs for both labor and instructional materials.

In light of these trends, it was inevitable that the Madison teachers involved in the process of individualization in the late 1960's began to confront serious implementation problems. In terms of curriculum development, the local option of having teachers create their own curriculum for each subject area became not only more expensive but nearly impossible when placed in an individual setting. The random collection of commercial curriculums being used left teachers without an integrating management system for pulling together the various curriculum options.

In terms of the management of instruction, the independent flow of pupils through different pathways in modular curriculums, each proceeding at his or her own rate, left teachers and students confused and both groups terribly short on instructional time. Students would wait for teachers to plan, diagnose, prescribe, and review. Teachers, on the other hand, would spend a large part of their time getting materials ready, writing on student progress cards and charts, sending messages home to parents, developing units of learning, finding assignments, and handing out materials.

In terms of retrieval of meaningful information, most manual systems were completely helpless in getting the right information to the teacher in the proper form exactly when it was needed. Whether the system used parents, aides, file cards, stick and hole cards, charts on the wall, or traditional grade books, the teacher spent too much time being a clerk and too little time being a teacher. Any information that could be found was totally unprocessed, no aggregation could be done, and no analysis could even be attempted without massive labor commitment.

In such an environment in which it is difficult to know what a child has done, what he or she is doing now, and what he or she will be doing in the future, individualization begins to break down. Staff commitment cannot overcome data overload for long.

Confronting just such a host of problems, a group of Madison teachers at Sherman Elementary School began a cooperative effort with the University of Wisconsin Laboratory of Experimental Design to develop a CMI system whose purpose was to provide a feasible means of implementing individualization. This effort began in 1972 and, after a year of systems work, MICA Level 1 was piloted at Sherman School using the teacher-designed math curriculum.

Underlying this effort was the development of an acceptable philosophy of instruction that such a CMI system was to support. The central principle was that teachers should be 100% free of all clerical or non-instructional tasks and that all data processing should be done by machines or aides. Teachers should devote their time entirely to teaching and they should have all information required for instructional decisions readily at hand. These general feelings were captured in a Madison Public Schools Research and Development Department study of the Sherman effort which concluded that the real needs of individualization could only be met with a utilitarian system that could handle multiple schools, multiple curriculums, and a wide variety of instructional settings and philosophies. Such a system must completely remove the clerical burden from the teachers without imposing upon them arbitrary and unwanted decisions or information. The system must be interactive, operating while the instructional program operates, and fast enough to process information at a rate equal to the speed at which students come to decision points in the curriculum. Neither students nor teachers can afford to wait for proper information; it has to be immediately available. The software package must be flexible enough to fit a variety of commercial and home-grown curriculums rather than forcing a curriculum to fit the structure of the software. Lastly, the computer must be integrated into a total management and implementation

approach in order to utilize its capacity for handling the instructional sequence, space allocation, task allocation, material acquisition and development, and an instructional materials display and distribution strategy.

SYSTEMS CAPABILITIES

The system that will be described in the remainder of this paper is MICA Level 5, which will be completed in the late spring of 1976. An early version of Level 5 was released to the CMI schools in February, 1976. Level 5 has been designed to operate with multiple schools and multiple curriculums. Currently the system is written in ASCII FORTRAN which is a proposed standard for the industry. The system in Madison is operating on the University of Wisconsin's UNIVAC 1110 computer at the Madison Academic Computing Center (MACC). Level 6 is being designed to operate in ANSI COBOL using a CODASYL standard data base management system. For development purposes Madison will be using a Honeywell H6060 machine in Milwaukee.

The purpose behind the CMI system is to provide a means for successfully implementing and sustaining individualized programs of instruction by supporting the information needs of a wide variety of instructional programs and a diverse group of curriculums. Unlike most CMI programs, MICA was not designed to support one instructional philosophy, one type of curriculum, one type of computer language, or one type of computer hardware. MICA has been designed over the years to approach instruction in a utility fashion so that it is totally up to the school to select what type of instruction it wishes, whether it be an IGE grouping concept, self-contained classrooms, a file folder approach to individualization such as IPI, or any combination of approaches. On the curriculum side, MICA has been designed

to handle a broad spectrum of commercial and home-grown curriculums. Level 5 is rather structured in its approach, but Level 6, designed around data base management language, will allow very great flexibility of curriculum structure. In terms of computer application, Title III's goal has been a transportable system in at least two standard languages, FORTRAN and COBOL, which can operate with the minimum of conversion to the major vendors third generation medium or large scale time sharing machines. Because of its complexity, MICA is not applicable to small scale machines, but rather to machines that can be supported by regional networks, metropolitan school systems, and universities.

For the general reader ten topics of discussion have been selected which highlight how MICA can help the process of individualization. For a more detailed description one can consult on an instructional level the Teacher's Guide which explains the educational management of the system in the classroom. For the development of courseware in the curriculum data base one may consult the Curriculum Specialist Guide. In terms of the actual interactive operation of the program, the reader is referred to the Terminal Operator's Manual. For a detailed look at the structure and logic of the computer program, one can consult the Systems Documentation for Madison Public Schools Computer Managed Instruction Program MICA Level 5. If one is interested in the responsibilities of the data processing department for the operation of the system, one is referred to the Data Base Manager's Guide. If one is interested in the educational results of this year's effort, a year-end report will be available in the Title III Continuation Proposal, 1976-77. These documents, which replace Level 4 documentation, will be available for the cost of reproduction in July, 1976, and can be secured through Madison Public Schools Title III Computer Managed Instruction Program, Research and Development Department, 545 West Dayton Street, Madison, Wisconsin 53703.

III. SYSTEM CAPABILITY
MICA LEVEL 5

1. CURRICULUM CREATION
2. STUDENT REGISTRATION
3. GROUP CREATION AND CHANGE
4. ASSIGNMENT OF UNITS
5. PLANNING FOR A STUDENT
6. PRESCRIPTIONS/ASSIGNMENTS
7. TESTING
8. REPORTS FROM THE SYSTEM
9. UTILITY FUNCTIONS
10. SYSTEM SECURITY

PROGRAM GENERALITY

The goal of the project has been to develop a computer managed instructional system which can be feasibly applied to a wide variety of highly individualized curriculum packages and a wide variety of instructional settings.

- A. The MICA system makes no instructional decisions without teacher and/or teacher aide direction prior to or during a transaction.
- B. Each school can have as many curriculums as necessary.
- C. All schools can share the same curriculum.
- D. Each school can have up to 1500 students per curriculum
- E. All instructional data processing within the MICA system is done interactively in the school during the instruction hour.
- F. Structure of the curriculum can be used for different purposes for each new curriculum: the terms units/methods/tests/objectives/prescriptions need apply only to Sherman Math.
- G. User sees the language of the curriculum, not the language of the CMI system on all input/output.

1. CURRICULUM CREATION

The structure and the extent of the CMI data base must reflect the instructional content and construction of the curriculum and not vice versa.

Maximum Curriculum Size

- 1 (A) 120 units per curriculum.
- 1 (B) 4 methods (learning styles) per unit.
- 1 (C) 5 prerequisite units per unit.
- 1 (D) 24 objectives per unit.
- 1 (E) Tests are within methods so students can have different tests based on learning style.
- 1 (F) 10 tests per unit.
- 1 (G) 9 objectives per test selected out of 24 objectives per unit so there can be different objectives in a unit based on learning style.
- 1 (H) 18 patterns (logical outcomes) per test for generation of lists of assignments (prescriptions).

- 1 (I) Eight prescriptions per pattern of up to 52 characters in size plus the book title.
- 1 (J) Curriculum data base has room for maximum size curriculum. No other binding internal parameters need concern curriculum creators.
- 1 (K) A student history file record is created when a student is assigned to a unit. Student history file record has room for results of 10 tests per unit and 12 prescriptions per test for each student.

2. STUDENT REGISTRATION

The local school in a regional system must be onsite self sufficient in all aspects of maintaining their own student and curriculum data base.

- 2 (A) Prior to the first day of classes the data base manager is responsible for entering into the data base: name, birthdate, sex, and grade of student by school.
- 2 (B) There is room in the data base for recording six two-character pieces of information on each student such as standardized test score, Title I, SES data, etc. This is the responsibility of the data base manager.
- 2 (C) After classes have begun the terminal operator is responsible for the interactive registration of students using the terminal. This allows the aide in the school to add and drop students from the school file without having to call the information in to the data base manager.
- 2 (D) When a student is registered in the MICA system, he or she is given a student number which is unique to that student while he or she is registered in that district's MICA system. This student number is used in the instructional transaction to input information, while the student's full name is used to output information.

3. GROUP CREATION AND CHANGE

Whatever instructional information a CMI system can process for an individual (IPI), it should also be able to do for a number of students (PLAN), an instructional group of students (IGE), and a self-contained homeroom or one-room schoolhouse.

- 3 (A) Administrative Group (Homeroom)
The data base manager is responsible for gathering the administrative group information from the schools prior to the first day of classes. This data consists of a required group identifier (such as the homeroom number) and an optional group name and teacher name. There can be up to 30 groups per curriculum and up to 50 students per group.

3 (B) For a student to participate in a curriculum, he must be a member of an administrative group. Once a student is registered, the terminal operator interactively adds the student to an administrative group. The terminal operator can also move a student from one administrative group to another as homeroom composition changes. The student can only be a member of one administrative group per curriculum.

3 (C) Instructional Group

The classroom teacher is responsible for creating, changing, and disbanding instructional groups as needed during the school year. Instructional groups are entered into the data base interactively by the terminal operator. The instructional group is defined during the interaction at the terminal by declaring a required group identifier and an optional teacher name and group name. Each curriculum may have as many as 30 current instructional groups and up to 50 students in each group.

Unlike the administrative group which retains the same identifiers throughout the year, unless changed by the data base manager, the instructional group is totally dynamic as it reflects the changing instructional needs for grouping as the year progresses.

3 (D) A student can participate at one point in time in only one instructional group per curriculum. Once a student is a member of an administrative group within a curriculum and the selected instructional group has been created, the terminal operator can interactively add a student to the instructional group.

By moving a student to another instructional group, the student is automatically removed from his or her prior instructional group. A student need not be a member of an instructional group to participate in a curriculum.

3 (E) Using the interactive registration capability within the MICA system, the terminal operators in the school can:

1. add a student to a school and a curriculum.
2. remove a student from a curriculum.
3. remove a student from a school, which places the student in an inactive status for all curriculums.

3 (F) The data base manager, upon receiving the appropriate information from the school can:

1. transfer a student's complete record from one school's data base to another school's data base.
2. remove permanently a student and his records from the data base.
3. assign to permanent storage (tape) some past block of student history no longer needed for interactive inquiry while retaining a list of completed units.

4. ASSIGNMENT OF UNITS

The interactive dialogue at the terminal must reflect the instructional sequence of events that the student goes through as he progresses through the curriculum.

- 4 (A) Up to three units per curriculum per student can be simultaneously assigned.
- 4 (B) A student can be in six curriculums at the same time in the same school.
- 4 (C) The terminal aide can interactively assign the same unit to one student/many students/or an instructional group of students.
- 4 (D) A unit is either open (current) or closed (non-current). If it is closed, one knows whether the unit is closed because mastery has been attained, whether it was recorded mastered before the student began the curriculum, or whether it was closed without mastery.
- 4 (E) MICA allows one to:
 - 1. assign the next unit with forward prescription for all non-planned students; this suggestion can be rejected at the terminal.
 - 2. assign the next unit from a teacher-created plan unique to a student; this plan can also be changed.
 - 3. have no next pre-assigned unit; each unit must be selected one at a time as needed.
 - 4. have multiple next units.
 - 5. indicate unmet prerequisites for a next unit.
 - 6. remove a student from a unit and close the unit without indicating mastery.
- 4 (F) A unit may be closed for a student without recording mastery by having the terminal operator enter into the student's record that the unit was skipped.

5. PLANNING FOR A STUDENT

The planning interaction must be a conversational replication of the instructional decision making process teachers go through in planning.

- 5 (A) One may plan as many as eight units in advance, defining a unique route through the curriculum for a student.
- 5 (B) The plan includes the unit/the method/the number of days on the unit the teacher expects the student to spend. The time dimension is optional.

- 5 (C) The plan is created interactively for a student/many students/or an instructional group.
- 5 (D) The teacher may add units to the plan as needed, replacing those assigned to the student.
- 5 (E) One may modify the plan for one student only. Change unit/method/ number of days for one, many, or all units in the plan. Insert new planned unit between two already planned units. Delete any part of the plan. List the currently assigned units and the remaining planned units. This is displayed each time a change is made in the plan. Fast mode: list is not displayed each time a change is made.
- 5 (F) One may remove a plan from a student/many students/or an instructional group so the students revert to a curriculum defined pathway.
- 5 (G) One may get a list of all planned units for a student or many students or for an instructional group as well as all units currently assigned.
- 5 (H) One may get a roster of students planned for in an administrative or instructional group. This includes the number of units left and the name of the last unit in plan for each planned student.
- 5 (I) A redundancy check eliminates from anywhere in the remaining plan a unit which was also assigned to the student as an additional current unit after the plan was created, but before the student got to that unit through the plan.
- 5 (J) A sequential redundancy check removes a unit from the plan if the unit planned for is about to be assigned and is the same as the unit currently open.

6. PRESCRIPTIONS/ASSIGNMENTS

The probability of an event occurring in a self-contained classroom approaches one, while the probability of an event occurring in an individualized setting approaches zero. To get teachers to accept the latter state, the CMI system must insure that the probability of being able to plan for, handle, and record any event also approaches one.

- 6 (A) 127 book titles can be used for prescriptions for each curriculum where each book is identified to teachers and aides by a short name and to students by its literal name.
- 6 (B) A maximum of eight forward assignments or eight remedial assignments can be displayed to the student for each objective missed or mastered.

- 6 (C) Provide automatic selection of an assignment by type from prescription list for all objectives missed, once test results are entered.
- 6 (D) It is possible to select one or more prescriptions out of an entire list for each objective missed once the test results are entered.
- 6 (E) The MICA system indicates all assignments previously selected for a student to avoid redundancy.
- 6 (F) Update assignments for objectives missed by selecting additional assignments any time after test is taken.
- 6 (G) Prescribe and update assignments for one student/many students/ or an instructional group on the same unit.
- 6 (H) Prints study list for the student with the name of the student, homeroom, date, current unit, next test, objective title, short name of objective missed, the selected assignment, book title and pages, assignment type, next activity, and student number.
- 6 (I) Fast mode for assignment and update that suppresses printing of prescription selection list when choice is known ahead of time.

7. TESTING

The speed of the interactive transaction must be faster than the instructional interactions they are recording.

- 7 (A) Terminal operator enters objective name missed or mastered on a test depending on the curriculum's nature.
- 7 (B) Terminal operator can change a test previously assigned to the student and select another test which the student has taken or is to take.
- 7 (C) Scanner grading. 45 items per test. Up to 5 distractors per item and one correct answer or multiple right answers. Variable mastery criteria for passing an objective. Random item placement of up to 5 items for each objective.
- 7 (D) Next test selection either by choice at terminal or automatically determined for each curriculum.
- 7 (E) Using the scanner one can automatically grade and make assignments.
- 7 (F) Using the scanner one can grade and report results for teacher determination of mastery.

- 7 (G) It is possible to use multiple terminals accessing the same curriculum in the same school so a teacher with a scanner and a CRT display can grade in one room while an aide with a hardcopy terminal can prescribe in another.
- 7 (H) Test automatically assigned to the student which is considered inappropriate can be replaced with the appropriate test using the correction capability.

8. REPORTS FROM THE SYSTEM

One report mode should exist for each potential audience in the school community. The teachers want pre-formatted standard reports in the language of the curriculum that they can get interactively on demand that explains to them what is happening in the instructional process. School level researchers need an interactive query system for simple statistical analysis and program development. Regional researchers need the data base analysis in language compatible with the methodology of national statistical packages.

- 8 (A) Student history report for a student/many students/instructional group/or an administrative group indicating: current units assigned, unit in the past, all units assigned since a point in time in the past. This contains a complete report of all tests taken/results/assignments given/dates.
- 8 (B) Group report for an administrative group/instructional group. This contains current units, test assigned, and number of school days since they were assigned for each student in the group.
- 8 (C) Unit report for all students in curriculum with a complete distribution of the number of students on each unit, average number of tests taken, and the number of students on each unit for more than five school days.

Specific unit report identifying by homeroom the students on that unit, number of tests taken, number of assignments and objectives for each student, and the percentage of tests each objective was missed on (relative difficulty).

- 8 (D) Achievement listing for student/many students/or by instructional group or administrative group. List of all units completed, title of unit, number of days on the unit, number of tests taken on the unit.

This report also generates optional achievement statistics comparing the student with their grade level group, these are calculated by school and by curriculum.

- 8 (E) Readiness reports for forming groups showing number of students not having yet mastered a unit, number having met the prerequisites and names.
- 8 (F) Curriculum progress report of the number of students who have completed a given unit and their names.

- 8 (G) Administrative report.
Administrative group report across curriculums that shows what unit each student is on in each of the curriculums in which he is participating, the number of days since he has been assigned the unit, the test he is on, and the number of days since he was assigned that test.
- 8 (H) Tally report.
Monitors MICA utilization and performance: type and number of transactions, terminal operator's errors, and the number of students processed at each school and in each curriculum daily and cumulatively.
- 8 (I) Contact report for all students at a school in a curriculum that lists students not having test results recorded since a given date; who have been on a unit for more days than were planned for; who have been on a unit for more days than considered typical for a unit.
- 8 (J) Test item analysis (not available interactively but can be generated in batch mode).
- 8 (K) Publishers report which notes the total number of assignments in the curriculum by type from a given textbook. It also lists those assignments by unit/test/objective/and pattern number. These prescriptions can be deleted totally or edited and changed one by one so new textbook adoptions can be added to the data base.

9. UTILITY FUNCTIONS

The computer must not make any apriori curriculum or instructional decisions, yet once made by teachers the CMI system must give the staff the option of changing any and all decisions at any time.

- 9 (A) Able to modify all parts of the curriculum data base: units/methods/objectives/tests/prescriptions. This option is available only in batch mode to the data base manager.
- 9 (B) Modify the dates in the student record so that they accurately reflect the actual date of occurrence.
- 9 (C) Delete a unit and all information concerning that unit from a student's record. If that unit appears many times in the record, one can select the appropriate one to delete.
- 9 (D) Eliminating just the information recorded on the last transaction entered for any unit in the student's record. This is a transaction that can be repeated as one walks back through each recording of test results within a unit.

- 9 (E) It can be noted in the student's record that any portion of the curriculum has been previously mastered before the student has attempted the unit.
- 9 (F) The data base manager can define and change the school calendar in terms of actual school days for report generation purposes.
- 9 (G) Through dictionary maintenance the syntax and spelling for all literal information in the data base can be edited.
- 9 (H) It is possible to send free format messages both from the data base manager to the individual schools and from the schools to the data base manager. In the first case a broadcast method is used and the message is automatically received at each terminal when the operator next signs on. However, messages sent to the data base manager are received only when he signs on, calls the service module, and requests the printing of any messages.
- 9 (I) Communications with the computer can be maintained at the schools between instructional transactions for any length of time without having to reconnect the terminal to the computer after any arbitrary period of time.
- 9 (J) At any time the terminal operator can change from one curriculum to another. This allows the MICA system to handle many curriculums in one school on one terminal at the same time.
- 9 (K) A manual backup system is provided for when the computer is not working or available.

10. SYSTEM SECURITY

If one is serious about regional centers, then one must handle 100 schools, 100 curriculums, and 100,000 students, and at any time know what curriculums are out there, what they are like, who is out there, what they are doing, what they have done, and what they will do.

- 10 (A) Each terminal operator in each school must have a password to sign on to the system.
- 10 (B) Each curriculum within each school has a password to prevent unauthorized use of that curriculum.
- 10 (C) The data base manager can monitor and change the curriculum passwords for security purposes.

- 10 (D) The data base manager can monitor the movement of students into and out of curriculums and schools and retrieve reports on those students regardless of their active status.
- 10 (E) The data base manager has the ability to shift from school to school in his monitoring activity while the terminal operator at a school has only the ability to shift from transactions in one curriculum to transactions in another authorized curriculum for that school.

IV. CONCLUSION

The preceding outline was intended to give the general reader an indication of the capabilities and options available through the MICA system, Level 5. For a complete picture of these features and a fuller understanding of the capabilities of the system, the reader is referred to the documents listed on page 10. During 1975-76 the system has been operational in six elementary schools in Madison. It is supporting over 800 fourth and fifth grade students in two math curriculums. The main math program, Sherman Math, is a homegrown individualized curriculum consisting of 70 units, 240 learning objectives, 220 unit pre- and post-tests, 7000 test items (42,000 distractors), 10,000 assignments out of 90 major commercial textbooks, and 200 manipulative/multi-media learning experiences. The second math program is a commercial curriculum, Continuous Progress Lab Mathematics, intended for enrichment purposes. This curriculum is built around CPL cards which function much like a unit in Sherman Math. Currently the 500 Series cards are in use.

Beyond these two operational curriculums, the MICA system is supporting twelve experimental curriculums and information systems. The scope and the diverse purposes of these applications gives one an indication of the flexibility of the MICA system. These experimental versions range from a third grade homegrown curriculum developed at Lapham elementary school in Madison to the Scott Foresman Reading System. In the spectrum of curriculums the range is from Moffett Language Arts to an individualized physical education program being developed at Memorial High School. In the area of social studies the MICA system is supporting a trial curriculum built around the Wisconsin State Department of Public Instruction's Social Studies Skills List and commercial materials from

Holt Data Bank and TABA. In terms of tracking skill development throughout a student's years in school, Madison is also investigating a skills assessment system and a reading skills profile system for the East Attendance Area. Both of these approaches concentrate on tracking basic skill development across grades for individual students and passing that information along with the student from teacher to teacher and from grade to grade with each teacher continually assessing skill growth. One experiment in student evaluation is being done with an evaluation system developed for an alternative high school in Madison. During each nine weeks course offered by the diploma completion program the staff and the students will have the opportunity to record attitude and attainment of each other and then to quantitatively compare those perceptions. In terms of non-curriculum related tasks, the MICA system is supporting an information system that tracks the referral process of the special education department as students are screened through a multi-disciplinary team effort. The Title I staff at the administrative level is experimenting with using MICA to summarize and track the needs assessment screening process for Title I students. The Special Education teaching staff at one school is also exploring the use of the MICA system for maintaining and generating mandated evaluation report information on their students' skill development and readiness.

The greatest future for the MICA system lies in the exploration that is currently going on with major publishing houses in the area of reading and mathematics to support commercial individualized programs that are distributed nationally. Since the MICA system was designed for exportability as a software package, the logical users would be schools throughout the nation that could share the benefits of commercial curriculums whose information management design could be acquired along with instructional materials. With the development of MICA, Level 6, which will have a data base management design, the

ability to handle the spectrum of commercially available curriculums will be greatly increased. It is the feeling of the Title III staff that removing the burden of both curriculum development and information management from the teachers in local schools will enable individualized instruction to be successfully implemented in many more schools than would otherwise be possible.